3.3 Hydrology and Water Quality

The only perennial surface water body in the Facility vicinity is the Lost River. Intermittent seasonal drainages also exist within the area. Several irrigation canals facilitate seasonal surface drainage and water transport for agricultural crops and pasture lands in the basin areas. In addition, shallow and deep aquifers underlie the area. Construction and operation of the proposed Facility would utilize water from the deep basalt aquifer, which test data suggests is not hydraulically connected to the shallow aquifer or surface water features in the project vicinity. The Facility would reconfigure the Babson well so that it draws water only from the deep system. The Babson well is the only known well to intersect the deep aquifer system in the project area. There would be no discharge of wastewater to surface or groundwater.

Process wastewater from the Energy Facility would be managed by one of three alternatives:

- Beneficial use of the water for irrigated pasture
- Evaporation in an onsite, lined evaporation pond
- Temporary storage onsite and hauling to a WWTP for offsite disposal

Sanitary wastewater during operations would be treated and managed using an onsite septic drainfield. During construction, Portable toilets would be provided for onsite sewage handling during construction and would be pumped and cleaned regularly by a licensed contractor.

The information presented in this section is based on the studies and analysis conducted for the SCA as amended by Amendments No. 1 and No. 2, filed with the EFSC on July 25, 2003, and October 15, 2003, respectively.

3.3.1 Affected Environment

The analysis area[12] is located within the Klamath Ecological Province (East Cascades Ecoregion), on the eastern side of the Cascade Mountains. This region is characterized by large basins surrounded by ancient lake terraces and basaltic fault block mountains. Elevations range from around 4,000 to 8,400 feet. The soil in the area is derived from basaltic parent material and generally have loamy surface horizons overlaying loamy to clayey subsurface horizons. A silica cemented hardpan occurs at depths of around 3 feet in many of the ancient dry lakebeds in the area (Anderson et al., 1998; Franklin and Dyrness, 1988).

The climate is characterized by warm, dry summers and cool, moist winters. The average annual precipitation in Klamath County is 14 inches, of which only 27 percent occurs during the growing season. The average winter temperatures range between 16.4°F and 37.8°F, and the average summer temperatures range between 39°F and 71°F (Anderson et al., 1998).

[12] Analysis area as described in this section consists of the survey area of the Energy Facility site and a quarter mile on either side of the centerline of the linear features.

3.3.1.1 Surface Water

No surface water bodies are located on the Energy Facility site. The access road for electric transmission would cross three seasonal creeks. Regional and local hydrologic features are described below. As described in Section 3.3.1.2, the area's deep aquifer system is isolated from surface water in the vicinity of the proposed project.

Hydrology. The Facility site lies within the Klamath River Basin. By geographic definition, the Klamath Basin is the area drained by the Klamath River and its tributaries. As the Klamath is one of only three rivers that pierce both the Cascades and the Coastal mountain ranges before emptying into the Pacific Ocean, the entire Basin is an area encompassing portions of south-central Oregon and northern California—an area roughly twice the size of Massachusetts. In Oregon, the Klamath Basin occupies more than 5,600 square miles and covers almost all of Klamath County and smaller portions of Jackson and Lake Counties to the west and east. At the California-Oregon border, the Klamath River Canyon marks the Basin's low point and at an elevation of 2,755 feet, is its drain point. Water bodies within the Klamath Basin are overappropriated, and the state of Oregon is currently adjudicating Klamath River Basin water rights for those with claims dating prior to 1909.

Lost River. The Lost River watershed is a closed, interior basin covering approximately 3,000 square miles of the Klamath River watershed in southern Oregon and Northern California. The headwaters originate east of the Clear Lake Reservoir in Modoc County, California, and flow approximately 75 miles to the Tulelake Sump. Seasonal flows in the Lost River are controlled by releases from the Clear Lake Dam. Historical channel modification, water diversion, and wetland drainage associated with the U.S. Bureau of Reclamation's Klamath Project have resulted in a highly altered system. Water from the Lost River is currently used for domestic and industrial water supply, irrigation, and livestock. The Lost River is the only fish-bearing perennial habitat in proximity to the analysis area. The closest section of the Lost River is approximately 2 miles north of to the Energy Facility site. The Lost River is approximately 0.4 miles north and east of the Babson well.

Intermittent Creeks. Several intermittent creeks were observed in the analysis area during field surveys. These creeks were dry at the time of the surveys, but had defined bed and bank features. Most of the drainages either lacked vegetation or contained only sparse upland vegetation within the channel. The habitat values of these creeks are discussed in more detail in Section 3.5, Fish.

Irrigation Canals. Several irrigation canals have been excavated to facilitate surface drainage and water transport for agricultural crops and pasture lands in the basin areas. These channels appear to be routinely maintained and were largely devoid of vegetation.

Surface Water Quality. ODEQ is required by Section 303(d) of the Clean Water Act to identify water bodies that do not meet standards for conditions such as temperature, pH, or toxics. The standards set by ODEQ are designed to protect beneficial water uses like drinking, agricultural use, recreation, industrial water supply, and cold water fisheries. The Klamath Basin has portions of 46 different rivers and lakes which, for one reason or another, have failed to meet these standards. While the area's high summer temperatures account for many of the listings, water bodies such as the Klamath and Lost Rivers fail several different standards, some of which persist throughout the year.

3.3.1.2 Groundwater

Hydrology. Subsurface hydrology in the analysis area is characterized by a shallow aquifer system and a deep aquifer system. The deep aquifer system is overlain by approximately 1,100 feet of volcanic rock that confines the deeper aquifer system (below 1,500 feet). Above the 1,100 feet of volcanic rock that separates the deep aquifer system, lies approximately 500 feet of permeable rock that constitutes the upper (shallow) aquifer, a heavily appropriated basalt aquifer that is in varying degrees of hydraulic connection with the Lost River. The shallow aquifer system is used for irrigation, stock watering, and domestic water supply. The project proponent would not use water from the shallow aquifer system.

The sole source of water for construction and operation of the Energy Facility would be groundwater from the deep aquifer system intercepted by an existing well known as the Babson well. No other Langell Valley area wells or water rights in the deep aquifer system are known to exist. The Babson well is located approximately 2 to 3 miles east of the Energy Facility, and is reported to have been originally drilled to depths exceeding 5,000 feet for oil and gas exploration in the 1920s, and currently has partial obstructions at depths of 1,870 and 2,050 feet. Previous borehole geophysics and aquifer testing at the Babson well (CH2M HILL , 1994) indicated the presence of two separate aquifer systems within the upper 2,050 feet of the borehole. The deep water-bearing zones that are present below a depth of 1,500 feet would be the sole supply water for the Energy Facility.

Because of this lack of other deep wells to provide information, the areal extent, recharge area, and recharge rate of the deep aquifer system are not well known. Accordingly, an assessment of the likely recharge area was performed (CH2M HILL, 2002a). The assessment concluded that the recharge area probably is higher in altitude and located about 20 to 50 miles to the east and north of the Babson well. It also concluded that the recharge area likely is regional in scope, with a minimum size of approximately 1,100 square miles. Based on these conclusions, and using local precipitation figures and the most likely range of known aquifer recharge rates in central Oregon, it is conservatively estimated (i.e. a minimum estimate) that the deep aquifer's annual recharge volume is between 134 billion and 241 billion gallons. Table 3.3-1 provides a summary of the annual recharge volume calculations.

An intensive 30-day aquifer test in 1993 at the Babson well (CH2M HILL , 1994) suggested that the deep groundwater-bearing zones below 1,580 feet are hydraulically isolated from the shallow aquifer system and surface water in the vicinity of the Energy Facility. For the test, the deep aquifer at the Babson well was pumped at a rate of 3,260 gpm for 30 days while water levels were monitored at 23 different locations within approximately 4 miles of the Babson well. Because no other wells are known to be completed in the deep aquifer within the project area, the monitoring locations consisted of numerous wells completed in the shallow aquifer system, two staff gauges along the Lost River, the Bonanza Springs, a well hydraulically connected with the Bonanza Springs, and a well in connection with a nearby marsh. No effects due to pumping the deep aquifer were observed at any of the monitored wells, the Lost River, Bonanza Springs, or the nearby marsh. Consequently, the results of the aquifer test indicate there is no observable hydraulic connection between the deep aquifer system at the Babson well and the shallow aquifer or surface water features.

A second aquifer test was performed in the summer of 2002 (CH2M HILL , 2002b). The Babson well was pumped at an average rate of 6,800 gpm for approximately 30 days. An expanded observation well network was used (31 different locations) that included both shallow wells and deeper irrigation wells in Langell Valley, Yonna Valley, Swan Lake Valley, Malin, and Klamath Falls. There was a hydraulic response in the observation well network attributable to a leaking well packer. This aside, the data do not indicate that the deep system is in hydraulic connection to a shallow aquifer system. A reconstructed well should eliminate the minor response observed.

Deep aquifer response suggests extremely high aquifer transmissivity and supply: at the end of the 30-day pumping period, water levels had recovered to the pretest static level within 5 minutes. These observations show that the roughly 294 million gallons withdrawn for this test were insignificant relative to the rate and volume of water available to the Babson well. Appendix B presents the Executive Summary from the *Water Supply Supplemental Data Report: Deep Aquifer Testing at the COB Energy Facility Water Supply* (CH2M HILL, 2002a).

Groundwater Quality. Groundwater quality within the shallow aquifer varies to some degree depending on local soil conditions and degree of connectivity between ground and surface waters. Since July 1991, fecal coliform has been found in several of the town of Bonanza's domestic wells. According to OWRD, studies compiled by Klamath County hypothesize that consecutive drought years forced farmers and ranchers to irrigate more heavily with groundwater. The drawn down aquifer permitted infusions of Lost River water, which carried in the contaminants.

The proposed project, however, would utilize deep zone groundwater. The deep zone groundwater is of high quality, with very low dissolved solids and no parameters suggesting interaction with shallow groundwater and surface water. The deep zone groundwater from the Babson well meets Federal drinking water standards without treatment. Because testing has demonstrated that deep system withdrawals would not impact shallow system water levels and the Facility would not discharge wastewater to the shallow groundwater system or surface water, Facility operations would not have an impact on existing groundwater quality.

3.3.2 Environmental Consequences and Mitigation Measures

As described below, the Energy Facility would have no significant unavoidable adverse impacts on hydrology and water quality.

<u>Impact 3.3.1. Water for the Energy Facility would be diverted from the deep aquifer, which is not hydraulically connected to surface water bodies.</u>

<u>Assessment of Impact</u>. Under annual average conditions, the Energy Facility would need 162 gpm of water (72 gpm for year-round industrial use and 90 gpm for seasonal irrigation use) to supply its water requirements. Under maximum consumption conditions, that rate would increase to 300 gpm (210 gpm for year-round industrial use and 90 gpm for seasonal irrigation use) for brief periods of time. In addition, construction of the Facility would result in the use of approximately 6.5 million gallons of water. Tables 3.3-2 and 3.3-3 show estimated water use during Facility construction and operation, respectively.

Water to supply this demand would be withdrawn from the deep aquifer using a reconstructed Babson Well and two additional water supply wells. Figure 3.3-1 shows a schematic of how the Babson well would be reconstructed. The water would be conveyed to the Energy Facility site via a 2.8-mile pipeline. On April 24, 2002, the project proponent submitted to OWRD a water right application for this use. A draft water right permit was issued by OWRD in a PFO dated April 22, 2003.

Test data do not indicate that pumping at the proposed rates would lower the water level in the deep aquifer. A 2002 aquifer test conducted at near-maximum rates (approximately 6,800 gpm) withdrew more than 290 million gallons from the deep aquifer over a 30-day pumping period. Within 5 minutes of the test's conclusion, water levels in the deep zone had recovered to the pre-test static water level. The much faster than anticipated recovery suggests that the volume removed (290 million gallons) is not significant relative to the rate of recharge to the deep system and that pumping would not significantly impact deep zone water levels.

The annual groundwater usage proposed for the Energy Facility is a small fraction of the estimated annual recharge to the deep aquifer from precipitation. (Table 3.3-1). The recharge estimates presented in Table 3.3-1 are considered conservative (i.e., minimums, or under-estimates) because they account for only a portion of the total possible recharge area, and do not consider deep interbasin groundwater flow that likely contributes additional recharge to the Klamath Basin. On an annual basis, the Energy Facility would use approximately 110.4 million gallons of groundwater from the deep aquifer system, assuming the Energy Facility is operating under maximum water consumption conditions (maximum ambient conditions and using supplement duct firing) for 365 days per year. This is a conservative estimate; actual water usage would likely be much less. For example, if the Energy Facility operated at an annual 72 percent capacity factor, water use would be approximately 7.0 million gallons (assumes average annual ambient conditions and a typical summer daytime average for process water rates and a monthly profile of operating conditions with and without supplemental duct firing).

It has been estimated that the deep aquifer system receives, at a minimum, anywhere from 134 billion to 241 billion gallons (from 411,000 to 739,000 ac-ft) of recharge from precipitation. When compared to the range of recharge estimates, the Energy Facility's groundwater usage would amount to less than 0.05 percent of the water that recharges the deep aquifer from precipitation on an annual basis. With the likelihood that the deep aquifer is recharged over a broader area and receives additional recharge from other hydrologic basins, the Energy Facility's groundwater usage would probably be less than 0.05 percent of the aquifer's recharge volume. Therefore, the impact on the deep aquifer is expected to be insignificant, consistent with the observed hydraulic response to pumping.

Aquifer and borehole tests have indicated that the shallow and deep systems are not hydraulically connected. No other wells or water rights are known to exist in the deep aquifer system within the project area. Therefore, no adverse effects on those waters potentially affected would occur as a result of the proposed Energy Facility. Because the Energy Facility would be developing a new water source, not appropriating from existing sources, the proposed use would not impair the availability of water for beneficial purposes such as drainage, sanitation and flood control.

Recommended Mitigation Measures. The proposed Energy Facility would include a number of features to reduce water use. During construction, rinse and wash waters would be cascaded from system to system to minimize water use. In addition, steps would be instituted to ensure that dust suppression water use is not excessive or insufficient.

The Energy Facility was originally designed for wet cooling by control of the cycles of concentration (ratio of the concentration of contaminants in the circulating water divided by the incoming makeup water contaminant level) to approximate the quality of the water in the Lost River and water used by the local irrigation districts. This would have resulted in a peak water demand of approximately 9,900 gpm (14.26 mgd or 43.76 ac-ft/day or 22.06 cfs). The wet-cooled design was further refined to incorporate water treatment and recycling to increase the cycles of concentration and reduce the peak water use to 7,500 gpm (10.80 mgd or 33.14 ac-ft/day or 16.71 cfs)or by 24 percent.

In response to public comments regarding the amount of water use, the design was changed to switch from wet cooling to air cooling. Air cooling reduces the Energy Facility water requirements by 97 percent (210 gpm vs. 7,500 gpm). As with the original SCA, an additional 90 gpm would be used for irrigation around the Energy Facility site.

Water use in the Energy Facility would vary daily and seasonally in response to fluctuating electricity demand and weather conditions. As a result, actual daily water use at the Energy Facility is estimated to vary from 0 gpm when the Energy Facility is offline up to a maximum of 210 gpm (0.30 mgd or 0.92 ac-ft/day or 0.47 cfs). For average annual conditions with duct firing, it is anticipated that the average withdrawal rate from the water supply wells would be approximately 72 gpm (0.10 mgd or 0.31 ac-ft/day or 0.16 cfs).

Impact 3.3.2. Wastewater and stormwater discharge during Energy Facility construction and operation could affect surface and groundwater quality.

Assessment of Impact. Sanitary sewage, process blowdown, cooling system blowdown, and stormwater runoff would be generated by the Energy Facility. Treatment and management would occur on-site, with no discharge of wastewater to surface or groundwater under the preferred alternatives.

3.3.2.1 Process wastewater

Process wastewater from the Energy Facility would be managed by one of three alternatives:

- Beneficial use of the water for irrigated pasture
- Evaporation in an onsite, lined evaporation pond
- Temporary storage onsite and hauling to a WWTP for offsite disposal

Irrigated Pasture Beneficial Use. If process wastewater is managed by beneficial use of the water for irrigated pasture, water developed during the winter months would be stored and combined with process water produced in the summer months to irrigate approximately 31 onsite acres. The Energy Facility site and land immediately adjacent to the Energy Facility under option by the project proponent, encompasses sufficient acreage with soil types suitable for this activity that the process water can be managed without exceeding annual salt loading rates typical of nearby irrigated lands, or other facilities with permits to use similar water in a similar fashion (see Section 3.2.2 for more detail).

The process water would be used to improve grazing forage yield in areas currently without irrigation, and possibly to enhance the wildlife forage yield in habitat mitigation areas. This activity represents a beneficial use of the water that would not be made if it were evaporated or hauled offsite for disposal. The irrigated pasture use would occur only in areas with well-drained soil and with suitable slopes to minimize the potential for surface runoff or erosion. The irrigated use would not occur in areas that are drained by subsurface drain tiles to minimize any potential discharges to surface water. Annual application rates would occur at levels substantially lower than gross irrigation requirements for full irrigation and the irrigated use would not result in recharge to groundwater during periods of irrigation.

Onsite Evaporation Pond. If process wastewater is managed by evaporation in an onsite, lined evaporation pond, process wastewater from the Energy Facility would go to an approximate 20-acre, lined evaporation pond. The evaporation pond would most likely be designed to store approximately 7 MG and operate passively. A spray enhancement system would be installed if it proved economically viable. A wastewater stream pipeline would take wastewater from the Energy Facility to the evaporation pond. The evaporation pond would be designed and sized to contain sediment from the wastewater for the life of the plant with minimal need to cleanout the sediment. This would require that there be sufficient freeboard in the evaporation pond while taking into account sediment accumulation. See Table 3.3-4 for a comparison of wastewater quality in a land application scenario and an evaporation pond scenario.

The pond would be designed to include a composite liner system for containment of wastewater and sediment. Bentonite would be added to the soil at the base of the evaporation pond, mixed to a depth of approximately 12 inches, and then compacted to achieve a permeability of greater than $1x10^{-6}$ centimeters per second (cm/sec). Alternatives to the bentonite-treated soil would be to use a bentomat geotextile system. The bentomat geotextile system is available with a permeability as low as $5x10^{-9}$ cm/sec. A 60-mil HDPE liner would be placed over the bentonite-treated soil or the bentomat geotextile system, to form the top layer of the composite liner system. The evaporation pond would be netted to prevent access by birds and surrounded by a chain-link fence to prevent access by wildlife.

Storage and Hauling to Wastewater Treatment Plant. If this alternative is selected, process wastewater would be managed by temporarily storing wastewater onsite in two 5.0-MG tanks and hauling to a WWTP for offsite disposal. The project proponent has contacted the two municipal WWTPs in Klamath Falls—the South Suburban Sanitary District and the City of Klamath Falls Sanitary District. The ability of these two WWTPs to accept wastewater from testing and commissioning of the Energy Facility and the wastewater from operation of the Energy Facility is presently being evaluated. According to managers at both facilities, each would be required to evaluate whether they can meet the EPA categorical standard to accept industrial waste or whether local ordinance provide for acceptance of truck-hauled wastewater. Over the life of the Energy Facility, other WWTPs may be constructed or considered for management of wastewater generated at the Energy Facility. The project proponent would arrange with a trucking company to routinely haul the wastewater stored in the wastewater storage tanks at the Energy Facility to the WWTP.

3.3.2.2 Sanitary sewage

Sanitary wastewater from restroom and shower facilities would be routed to an onsite septic tank, which would discharge to a leach field. Approximate flows of up to 1,500 gallons per day or about 1 gpm are expected. The onsite system would be designed in accordance with Klamath County's standards for onsite disposal systems. Percolation into the ground of treated sanitary sewage from the septic system would not have a substantial adverse effect on groundwater quality. During construction, portable toilets would be provided for construction worker use.

3.3.2.3 Stormwater

Construction. During construction, stormwater would be managed according to NPDES General Construction Permit 1200-C, issued by ODEQ, and an erosion and sediment control plan. In general, construction erosion control would consist of BMPs, including techniques such as hay bales, silt fences, and revegetation, to minimize or prevent soil exposed during construction from becoming sediment to be carried offsite.

Operation. While stormwater is not considered wastewater, stormwater would be managed at the Energy Facility by a 4.7-acre infiltration basin and therefore would be covered under a Water Pollution Control Facility (WPCF) permit. Under the preferred alternative, there would be no discharge of stormwater from the Energy Facility into surface waters, stormwater drainage ditches, or irrigation canals.

Stormwater is managed through three separate systems, including the plant drains system, the storm sewer system, and the stormwater run-on diversion system. Figure 3.3-2 shows a schematic of the three separate and segregated systems designed to handle stormwater during Facility operations. The figure shows individual drainage systems as well as a breakdown of the drains connected to each system. The individual drainage systems are described in more detail below.

Plant Drains System. A dedicated plant drains system would be designed and constructed at the Facility to segregate stormwater that comes in direct contact with plant components from the storm sewer system, thus preventing runoff in the plant drains system from reaching the stormwater pond or the infiltration basin. This design would be accomplished by separating the runoff from drains with the potential to come in contact with pollutants from the remainder of the storm drainage system. Drains in areas with the potential for contact with pollutants from materials used or stored at the Energy Facility would be routed to the segregated plant drains system, which would discharge to an o/w separator. This system includes drains inside buildings and enclosures and drains from the interior of spill containment berms. The resulting o/w separator discharge water would be routed to a wastewater collection basin and then pumped back to the raw water tank for use as process water. No stormwater collected by the segregated plant drains system would be routed to the stormwater pond or infiltration basin.

The wastewater collection basin would be a concrete sump placed in a location accessible to inspection without interfering with Facility operations. It would hold approximately 5,000 to 10,000 gallons.

The oil from the o/w separator would be contained in the o/w separator itself. The o/w separator would include a level indicator with an alarm that would alert the operations staff when it needs to be emptied. At that point, a licensed contractor would pump the oil out and haul it offsite for proper disposal.

The dedicated plant drains system would consist of the following components:

- Combustion turbine enclosure floor drains
- Steam turbine area foundation and floor drains
- Heat recovery steam generator (HRSG) foundation and stack floor drains
- Warehouse/maintenance building floor drains
- Administration building floor drains

Storm Sewer System. Stormwater that falls inside the fenceline of the Energy Facility and is not routed to the plant drains system described above would be collected in the storm sewer system. The collection of rainfall runoff in this system would be limited to parking lots, roof drains, graveled areas, and vegetated areas. This storm sewer system would consist of ditches, culverts, and piping that are routed to the stormwater pond. From the stormwater pond, there would be two alternatives for stormwater discharge. The preferred alternative would be to discharge the stormwater into a 4.7-acre infiltration basin. The second alternative would be to discharge the stormwater through a ditch adjacent to the Energy Facility access road into the West Langell Valley Roadside ditch, where it would eventually enter the High Line Levee Ditch and then the Lost River. These alternatives are described in more detail below.

Stormwater Pond. The captured runoff from the Energy Facility in the storm sewer system would be conveyed to a 2.5-acre-foot (ac-ft), 1.5-acre, 750,000-gallon stormwater pond, located in the southeast corner of the Energy Facility (see Figure 3.2-4). This stormwater pond would serve two purposes: 1) provide pretreatment of the runoff before it enters the infiltration basin, and 2) provide temporary storage should unwanted material make its way into the stormwater.

The stormwater pond would provide a wide spot in the stormwater flow path. This wide spot would reduce the flow velocity of the stormwater, allowing suspended sediment to settle out. The operating life of the infiltration basin would be increased by removing the sediment.

A ditch would be constructed from the toe of the fill for the Energy Facility over to the infiltration basin to convey stormwater in the stormwater pond to the infiltration basin. An 18-inch-diameter discharge pipe would be installed through the southern end of the dyke of the stormwater pond. The outlet would discharge into the ditch. The pipe would include a manually operated valve that would normally be closed. The 18-inch-diameter discharge pipe would drain the 2.3 acre-foot (1.5-acre) stormwater pond if it were full in approximately 5 hours.

The stormwater pond is not designed to detain a 100-year, 24-hour storm. It would detain only approximately 34 percent (2.3 acre-feet divided by 6.7 acre-feet). The spillway would be sized to handle the peak flow from the 100-year, 24-hour storm, which is approximately 112 cubic feet per second (cfs). The dyke of the stormwater pond would include a 2-foot-deep, concrete-lined flume directly above the discharge pipe. This flume would act as an emergency spillway for storms greater than the volume of the stormwater pond. The spillway would route stormwater overflow to the ditch that directs water into the infiltration basin. The 112-cfs peak flow would occur for less than 15 minutes and is not representative of the average flow for a 100-year storm.

Infiltration Basin Alternative. Though not accounted for in the preliminary basin sizing, evaporation of the collected stormwater would occur during the summer months. Vegetation would be planted in the bottom of the infiltration basin to improve the infiltration functions and protect these surfaces from rain and wind erosion. There are three primary reasons to vegetate the basin with native grasses or other suitable vegetation:

- The #1 cause of soil erosion in Klamath County is wind on barren soil.
- The infiltration basin would be a collection basin for windblown soil and noxious weed seeds. Although the soil could become resuspended by the wind, some seeds would germinate and overtime the basin would be vegetated by noxious weeds and require greater maintenance to remove weeds.
- Vegetation would help uptake any nutrients or potential pollutants that could be in the stormwater.

A chain-link fence would be installed around the infiltration basin to prevent debris such as windblown vegetation or litter from entering and settling on the basin bottom. The fence would also serve to prevent unauthorized personnel or wildlife from entering the basin. A gate would be installed in the fence to allow access for maintenance personnel and equipment. An access road would be constructed from the access road to the Energy Facility over to the infiltration basin (see Figure 3.2-4).

Runoff calculations were performed using the TR-20 hydrologic model. This model was developed by the Soil Conservation Service and the U.S. Department of Agriculture. The 100-year, 24-hour storm event was used to size the infiltration basin. This return event is consistent for the design of stormwater retention systems. The probability of a 100-year storm event to occur in any 1 year is one percent.

The infiltration basin would be located adjacent to the Energy Facility on Calimus series loam soil. The NRCS (Natural Resources Conservation Service) Soil Survey for Klamath County lists the saturated infiltration rate for this soil as 0.6 inch per hour (in/hr) to 2.0 in/hr. The infiltration basin was sized using the lower value of 0.6 in/hr. Using this lower infiltration value provides a conservative infiltration basin size.

The primary controlling factor in sizing the infiltration basin is the surface area of the basin bottom, the depth of water storage, and 1 foot of freeboard. One foot of freeboard is a typical design standard for stormwater ponds. Over-designing the infiltration basin would reduce the chances of the water overtopping the infiltration basin should a storm larger than the 100-year event occur or if back-to-back smaller storm events occur. A 48-hour drawdown period of the 100-year stormwater volume was used for sizing the infiltration basin and is consistent with the design requirements of similar functioning ponds, such as extended dry detention ponds. The additional 1 foot of freeboard would provide approximately 40 percent additional storage volume that could be filled by stormwater before overtopping would occur. Drawdown duration would be less than 48 hours for the more frequent return storm events.

West Langell Valley Road Drainage System Alternative: In this alternative, the outflow from the stormwater pond would go to a Klamath County drainage ditch along the east side of West Langell Valley Road. This drainage ditch discharges to an irrigation canal, labeled High Line Levee Ditch on the U.S. Geological Survey quadrangle map. High Line Levee Ditch eventually discharges to the Lost River. The drainage ditch along the east side of West Langell Valley Road is approximately 8,000 feet long and the irrigation canal to the Lost River is approximately 32,000 feet long. Therefore, stormwater from the Energy Facility site would travel approximately 40,000 feet before it reaches the Lost River.

The stormwater runoff calculations were performed using TR-55 software, which employs the Natural Resource Conservation Service (NRCS, formerly the Soil Conservation Service [SCS]) method for computing stormwater runoff. A weighted curve number of 88 was used for the Energy Facility site. For the same area, a weighted curve number of 69 was used to calculate the predevelopment runoff. A 25-year storm event consisting of 2.5 inches of rainfall was used as the design case for the stormwater pond. This storm event resulted in 1.38 inches of runoff from the Energy Facility site, which is approximately 1.5 MG. The peak predevelopment flow was calculated at 12 cfs (5,386 gpm) and was used as the peak outflow from the stormwater pond. The peak runoff from the Energy Facility site was calculated at 85 cfs (38,151 gpm) and was used as the peak inflow to the stormwater pond. Based on the predevelopment flow and the Energy Facility site hydrographs, the 1.5-acre stormwater pond is sized for 2.3 acre-feet or approximately 750,000 gallons.

Offsite Stormwater Diversion System. Stormwater diversion ditches would be installed on the north and west sides of the Energy Facility to divert stormwater form undisturbed areas adjacent to the Energy Facility from flowing onto the Energy Facility. These diversion ditches would direct water into existing natural drainage system or into the drainage ditch along West Langell Valley Road. Runoff to the south and east of the Energy Facility would naturally drain away from the Energy Facility.

Ancillary Facilities. For the water supply pipeline and transmission line access roads, culverts would be properly sized and designed where the access road crosses intermittent creek to facilitate flow of stormwater or snowmelt runoff and to minimize erosion. Access roads would be surfaced with gravel to minimize erosion. Drainage would be maintained along the route of the access roads to prevent ponding of stormwater or snowmelt runoff.

Recommended Mitigation Measures. No measures beyond those included in the proposed project are recommended.

Impact 3.3.3. Chemical spills at the proposed Energy Facility could affect surface and groundwater quality.

Assessment of Impact. Various chemicals, such as sulfuric acid, sodium hypochlorite, and sodium hydroxide, would be stored at the Energy Facility. The chemicals would be stored in totes or aboveground storage tanks situated in the appropriate containment areas designed to hold the volume of the liquids stored plus freeboard, according to applicable regulations and BMPs. Aqueous ammonia would be stored in a 30,000-gallon aboveground storage tank. The tank would be contained within a bermed area and would be designed in accordance with applicable industry specifications. The tank would be equipped with a level gauge and would be monitored from the control room. The area for delivery of aqueous ammonia to the storage tank also would be bermed. Because of these design features, any chemical spill that might occur at the Energy Facility would not adversely affect surface or groundwater quality.

SPCC Plan. A Spill Prevention, Control, and Countermeasure (SPCC) plan would be prepared and implemented at the Energy Facility. The SPCC plan would include an inspection program consisting of regular inspections and recordkeeping. It would be a detailed, Facility-specific, written description of how Facility operations comply with the prevention guidelines in the Federal oil pollution prevention regulation. These guidelines include such measures as secondary containment, facility drainage, dikes or barriers, sump and collection systems, retention ponds, curbing, tank corrosion protection systems, and liquid level devices. This plan is another level of protection to prevent stormwater runoff from coming in contact with pollutants.

The project proponent is required to ensure that wastes are appropriately handled onsite and disposed of at the proper facility and are transported by a licensed and reputable firm. Materials would be stored in sealed containers, and to the extent possible, those sealed containers would be stored in inside buildings.

Tanks storing chemicals, diesel fuel, or lubricants not located in buildings would be inside secondary containment structure or arrangement, such as perimeter berms or dual walls, in the event of a spill. After a rainfall event, the secondary containment located outdoors would be inspected prior to releasing stormwater to the o/w separator in the plant drains system. If any pollutants are present, they would be handled as called for in the SPCC plan.

Additional Precautions. The following is a description of precautions taken to minimize the chance for pollutants to come in contact with stormwater runoff:

- The generator step-up transformer foundations would include concrete containment sized to hold 110 percent of the oil in the transformers, which would account for the contents of the transformer plus a design rainfall event.
- Two storage tanks of approximately 2,200 gallons each would be used to store fuel for the Energy Facility's emergency generators would be located outdoors. These tanks would be surrounded by a concrete curb for secondary containment. The secondary containment would be sized to hold 110 percent of the volume of the tank, which would allow for the contents of the tank plus a design rainfall event.
- A 30,000-gallon aqueous ammonia tank would be located outdoors and would be surrounded by a concrete secondary containment sized to hold 110 percent of the volume of the tank. This containment volume would allow for the contents of the tank, plus rainfall.

These containments would include a drain with a valve that would be normally locked closed. Following a rainfall event, the containments would be inspected for pollutants. If no pollutants are visible, the valve would be opened and the water would be released to the plant drains system and o/w separator. If there is a leak or spill, the stormwater would be pumped out and hauled offsite by a licensed contractor for proper processing and disposal.

EDTA, hydrazine, amine, sodium nitrite, and sodium phosphate would be stored in sealed 400- to 500-gallon totes. Generator lube oil, combustion turbine lube oil, cleaning fluid/detergent, glycol, and caustic would be stored in sealed 55-gallon drums. The totes and 55-gallon drums would be stored inside the warehouse maintenance building and would be surrounded by concrete curbs for secondary containment. These curbs would be sized to hold 110 percent of the volume of the containers. Because these areas would be exposed to rainfall, these containment curb areas would not have drains. If service water enters the secondary containment, it would be allowed to evaporate. If a leak or spill occurs in these areas, it would be handled as described in the SPCC plan.

Recommended Mitigation Measures. No measures beyond those included in the proposed project are recommended.

3.3.3 Cumulative Impacts

The proposed Energy Facility would use an average of approximately 72 gpm for year-round industrial use (power generation) plus 90 gpm for seasonal irrigation use from the deep basalt aquifer. A draft water right permit was issued by OWRD on April 22, 2003. This draft permit was issued as No. 1 by OWRD, indicating the draft permit is the first permit issued for this water source. On August 19, 2003, OWRD provided ODOE with a revised recommendation and draft water right reducing the maximum instantaneous rate to 210 gpm for industrial use. This reduction reflects the change from wet cooling to air cooling. The draft water rate of 90 gpm for seasonal irrigation use remained unchanged.

As described earlier in this section, use of water from the deep aquifer is expected to have no effect on existing uses of the shallow aquifer or surface waters in the area. The proposed withdrawal is likely to be insignificant relative to the recharge capacity of the deep aquifer. Based on existing information, there are no known, past, present, or reasonably foreseeable users of the deep aquifer in the vicinity of the proposed Energy Facility. As a result, no cumulative impacts are expected to result from operation of the proposed Energy Facility unless other users were to apply for and obtain water rights in the deep aquifer.

TABLE 3.3-1
Estimated Annual Groundwater Recharge Volume to the Deep Aquifer System

Estimated Recharge Area:	1,100 sq. miles (approximately 704,000 acres)
Estimated Average Annual Precipitation in Estimated Recharge Area:	28 inches
Estimated Annual Recharge Volumes:	
At 25% of annual precipitation: (recharge rate = 7.0 in/yr):	134 billion gallons (411,000 acre-feet)
At 45% of annual precipitation: (recharge rate = 12.6 in/yr):	241 billion gallons (739,000 acre-feet)

TABLE 3.3-2
Estimated Water Use During Construction and Testing/Commissioning

Activity	Required Quantity (gallons)	Wastewater Quantity (gallons)	Final Disposition
Service/fire protection system filling	1,675,000		EP or OTD or IPBU
Demineralized water system commissioning	325,000		EP or OTD or IPBU
HRSG and auxiliary boiler cleaning and flushing	740,000	1,520,000	EP or OTD or IPBU
BOP/CTG/STG piping tests, flushes, and cleaning		580,000	EP or OTD or IPBU
Air-cooled condenser testing and cleaning		500,000	EP or OTD or IPBU
HRSG commissioning/Steam blows	3,760,000	2,150,000	EP or OTD or IPBU
Subtotal	**6,500,000**	**4,750,000**	
RO Reject	**Included in HRSG/Commissioning/ Steam Blows**	2,200,000	Land Application or Evaporation
Dust Suppression	**200,000**		Evaporation/ Absorption

TABLE 3.3-2
Estimated Water Use During Construction and Testing/Commissioning

Note: Water requirements shown are net water requirements added to the system and do not include reused or recycled water from other commissioning activities.

BOP = balance of plant
CTG = combustion turbine generator
HRSG = heat recovery steam generator
EP = evaporation pond
IPBU = irrigated pasture beneficial use
OTD = offsite treatment and disposal by licensed contractor
STG = steam turbine generator
RO = reverse osmosis

TABLE 3.3-3
Estimated Water Use and Disposition During Operations

Process Where Flow Starts	Process Receiving Flow	Water System Flows (gpm)*		Final Disposition
		Peak	Average	
Water supply wells	Raw water storage tank	210	115	Storage
Raw water storage tank	Demineralization process	317	130	Land application or evaporation
	HRSG blowdown tanks	100	100	Land application or evaporation
	Evaporative coolers	216	0	Land application or evaporation
	Potable water/sanitary systems	1	1	Septic system
	Service water	5	5	Land application or evaporation
	Fire protection	3,000	N/A	Storage
Reverse osmosis Treatment	Demineralization process	159	65	Demineralized water storage
	Wastewater storage tank	159	65	Land Application evaporation, or haul offsite to WWTP
Demineralized Process	Water/steam cycle	66	65	Land application or evaporation
	Wastewater collection basin	93	0	Land application or evaporation
Water/steam cycle	HRSG blowdown tanks	23	23	Land application or evaporation
	Evaporation	43	42	Evaporation
Evaporative coolers	Evaporation	108	0	Evaporation
	Wastewater collection basin	108	0	Land application or evaporation
HRSG blowdown tanks	Evaporation	8	8	Evaporation
	Wastewater collection basin	214	214	Land application or evaporation
Wastewater collection basin	Raw water storage tank	115	115	Storage
Stormwater from disturbed areas on Energy Facility site	Stormwater pond	Variable	Variable	Infiltration
	Stormwater infiltration basin	Variable	Variable	
Stormwater run-on from undisturbed areas	Plant stormwater by-pass drainages	Variable	Variable	Existing drainages and West Langell Valley Road drainage ditch

* Rates are for two blocks (1,160 MW) and are with supplemental duct firing.
HRSG = heat recovery steam generator
WWTP = wastewater treatment plant

TABLE 3.3-4
Process Wastewater Characteristics

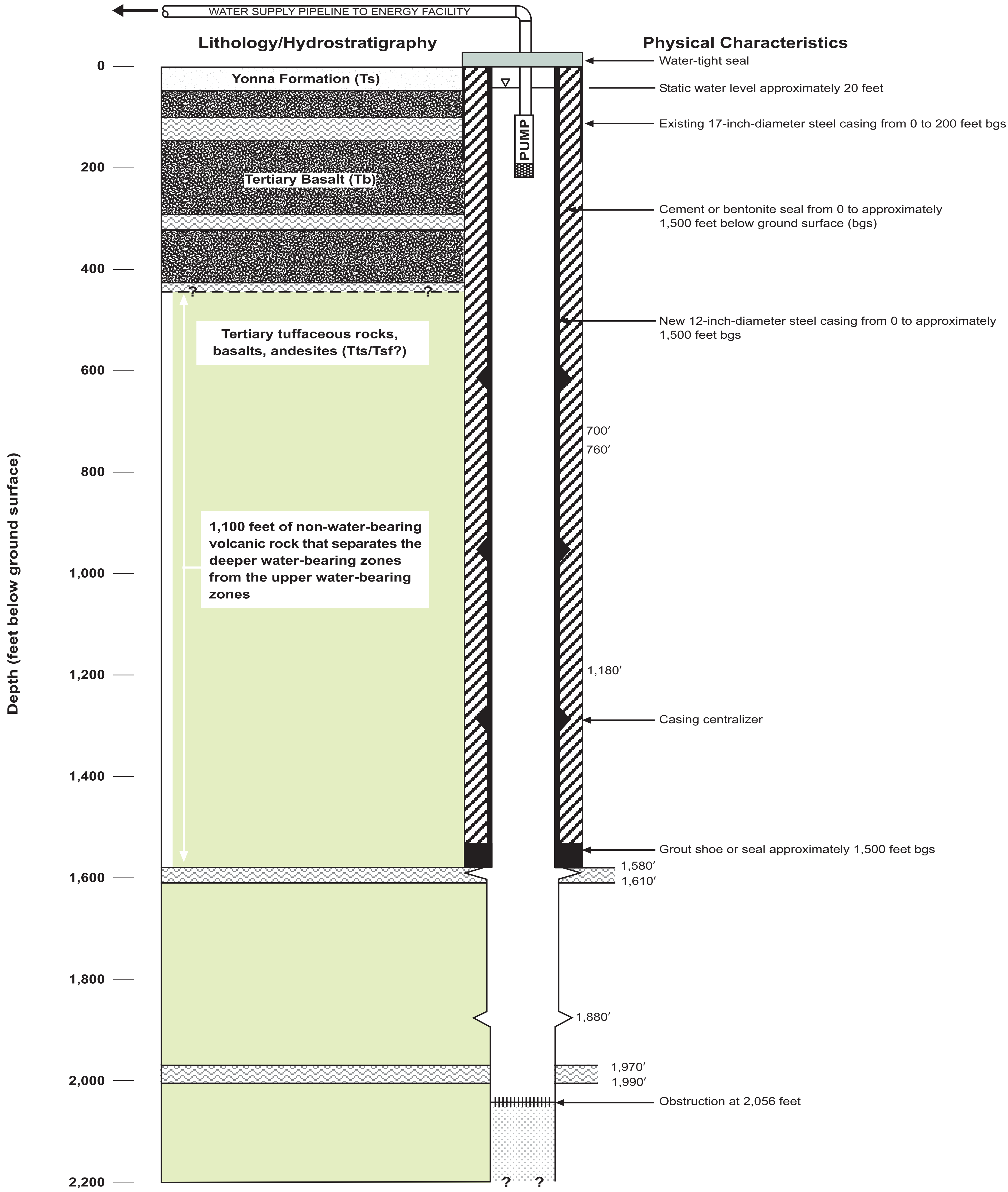
Parameter	Land Application Case	Evaporation Pond Case	Units
pH	7.5-9.0	7.5-9.0	Standard units
Iron	0.14	0.68	mg/L
Copper	0.00	0.032	mg/L
Manganese	0.02	0.044	mg/L
Calcium	28.92	65.6	mg/L
Magnesium	11.74	26.6	mg/L
Sodium	20.12	52.0	mg/L
Potassium	4.22	9.57	mg/L
Boron	0.54	1.22	mg/L
Silica	71.12	183.0	mg/L
Chloride	4.14	15.7	mg/L
Nitrate as N	0.84	1.9	mg/L
Nitrite as N	0.02	0.044	mg/L
Ammonia as N	0.00	0.35	mg/L
Sulfate	6.29	269.8	mg/L
Total Alkalinity	164.12	250.0	mg/L as $CaCO_3$
Fluoride	0.20	0.44	mg/L
Phosphorous	0.05	20	mg/L
Orthophosphate as P	0.05	20	mg/L
Sulfite	1.00	25.0	mg/L
Oil and Grease	0.30	10.7	mg/L
TOC	1.50	69.6	mg/L
TDS [1]	203	1,077	mg/L
TSS	1.00	1.0	mg/L
Phosphonates [2]	0.00	30.0	mg/L
Polyacrylate [2]	0.00	20.0	mg/L
Free Chlorine [2]	0.00	0.20	mg/L

[1] Includes treatment chemicals identified in [2].

[2] Added as treatment chemical.

$CaCO_3$ = calcium carbonate
mg/L = milligrams per liter
TDS = total dissolved solid
TOC = total organic content
TSS = total suspended solid

Proposed Babson Well Reconstruction Diagram—Air Cooled



LEGEND

Ts — Tuffaceous sedimentary rocks and tuff (Piocene and Miocene), AKA Yonna Formation—Semiconsolidated to well-consolidated mostly lacustrine tuffaceous sandstone, siltstone, mudstone, concretionary claystone, pumicite, diatomite, air-fall and water-deposited vitric ash, palagonite tuff and tuff breccia, and fluvial sandstone and conglomerate. Palagonite tuff and breccia grade laterally into altered and unaltered basalt flows of unit Tob.

Tb — Basalt (Upper and Middle Miocene)—Basalt flow, flow breccia, basaltic peperite, minor andesite flows, and some interbeds of tuff and tuffaceous sedimentary rocks.

Tts/tsf — This unit represents rocks that are indicated to occur beneath Tb in the project area but could not be differentiated here. Tts: Moderately well-indurated lacustrine tuff, palagonitic tuff, pumice, lesser siltstone, and sandstone and conglomerate. Tsf: Rhyolitic to dacitic bedded tuff, lapilli tuff, welded and nonwelded ash-flow tuff, and interbedded basalt and andesite flows.

Groundwater production zone.

1,080′ — Large void or fracture zone and corresponding depth in feet

Lithologic contact

Hydrostratigraphic contact

Notes

Borehole diameters will decrease as follows to 2,056 feet (diameters are approximations only):

20" = 200-380 feet
18" = 380-1,010 feet
17" = 1,010-1,090 feet
16" = 1,090-1,700 feet
14" = 1,700-Total Depth

Lithologic and hydrostratigraphic relationships are interpreted from borehole geophysics conducted by CH2M HILL in April 1993 and the stratigraphic descriptions provided in the Geologic Map of Oregon (Walker and MacLeod, 1991).

Figure 3.3-1
Proposed Babson Well Reconstruction Diagram—Air Cooled
COB Energy Facility
Bonanza, Oregon

PEOPLES ENERGY Resources

Figure 3.3-1
11 x 17

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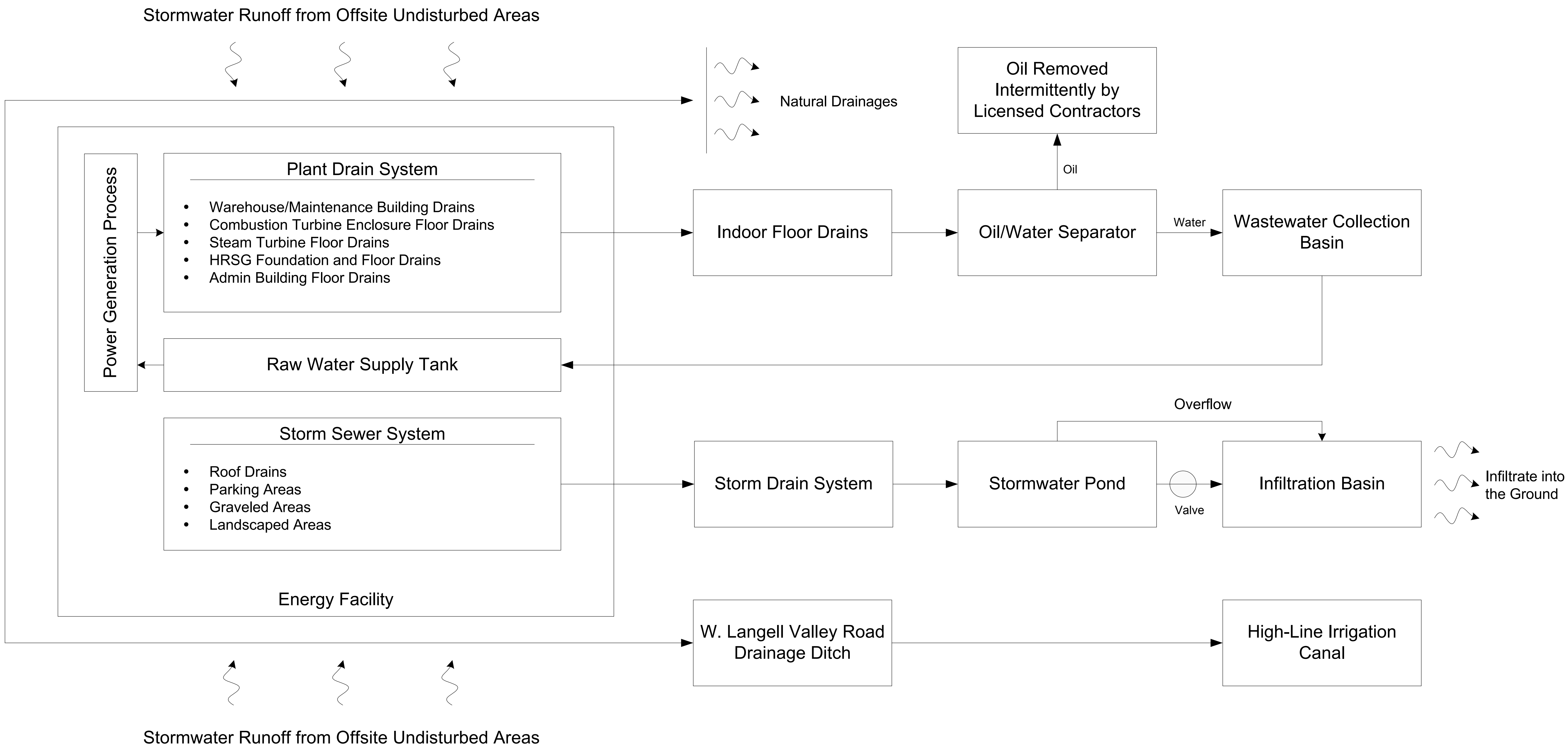

FIGURE 3.3-2
Stormwater Drainage Flow Schematic
COB Energy Facility
Bonanza, OR

PEOPLES ENERGY Resources

PDX/032950009.VSD

Figure 3.3-2

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